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Do more equal slices shrink the cake? An empirical investigation of tax-transfer reform proposals in Italy

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Abstract. A crucial issue in efficiency-equality evaluations of tax reforms resides in the possibility that the level as well as the distribution of welfare may change, where the household-specific measures of welfare capture the value of income as well as the value of leisure. A better-designed redistribution and income support system may not only foster equality but also improve the configuration of incentives and by this route contribute in its turn to efficiency. This paper presents an empirical analysis of the welfare effects for married couples of replacing the Italian tax system by three alternative hypothetical reforms: a flat tax, a negative income tax, and a work fare scheme. We employ a microeconometric model of household labour supply that represents partners' simultaneous choices, allows for constraints in the choice of hours of work, and is sufficiently flexible to capture a large variety of supply responses. These features appear to be crucial in the evaluation of reform effects. The results suggest that there is scope for improving upon the current system under both the efficiency and the equality criterion. The benefits from the reforms, however, come from unexpected directions since the largest labour supply contribution come from poor and middle class households whereas rich households appear to be much less responsive to

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changes in the tax rates. The simulation results reveal that a crucial role in shaping the results is played by the relatively higher behavioural responsiveness of married women living in low and average income households.

JEL classification: D19, D69, J22

Key words: Tax reforms, labour supply, welfare gains and losses, efficiency-equality trade-off, social welfare

1. Introduction

In the last few years a debate has developed in Italy upon reforming the tax-transfer treatment of households. Although with some delay, the debate follows closely enough policy discussions that are going on in other OECD countries, and moves around two focal issues. The first one concerns the possibly large loss in efficiency due to disincentives and distortions on worker behaviour caused by progressive taxation. The reform proposals that are mainly motivated by such arguments tend to suggest a flatter profile of the marginal tax rates (with the pure "flat tax" as a limit case) together with a reduction of the levels of the tax rates. The second issue stems from the widespread observation that the current Italian system of transfers and benefits directly or indirectly related to supporting the life standard of needy or poor or in any sense disadvantaged households performs rather poorly both in terms of cost-effectiveness and fairness. The reform proposals that are mainly inspired by this concern by and large converge in supporting some more or less universal basic transfer, or basic guaranteed level of income, or basic endowment.

The picture is mirrored into the political platforms of alternative coalitions. Since the publication of a "Libro Bianco" on behalf of the Ministry of Finance in 1994[1], up to the tax reform proposals contained in the 2001 election platform, the quest for lower and "flatter" tax rates has been supported with more energy by the centre-right coalition ("Casa delle Liberta"), while the concern for a more equitable and cost-effective system of income support and redistribution has been more a policy focus of the recent centre-left governments[2] ("Ulivo") as well as of the electoral platform of the centre-left coalition. It must be recognised however that the two issues are more complementary than alternative. For example, a non-technical article by Rizzi and Rossi (1997) proposes an overall reform of the tax-transfer system combining a basic universal transfer with a flat tax, very much in line with the arguments developed in Atkinson (1995). A similar proposal, under the label of "Social Dividend", was included in the 2001 electoral platform of the centre-left coalition[3].

Previous exercises applied to Italy have adopted non-behavioural simulations for evaluating reforms similar to the ones mentioned above.[4] When account is not taken of behavioural responses, the dimension of the (gross) "cake" is obviously fixed. However, the crucial issue in efficiency-equality evaluation resides precisely in the possibility that the dimension (along with the distribution) of the cake *may* change. Less distortionary tax rates *may* generate a larger amount of resources available for redistribution; a better

designed redistribution and income support system *may* not only foster equality but also improve the configuration of incentives and by this route contribute in its turn to efficiency. In this paper we use a model of household labour supply to evaluate stylised versions of the above reform ideas. A behavioural model might reveal the possibility of improving both efficiency and equality. We use a pre-estimated household labour supply model, briefly described in Appendix A.

The social evaluation methodology we use is a generalisation of King (1983), where measures of welfare are derived from equivalent incomes defined in terms of a reference household and of the prices (wages) and opportunities that this household faces. The introduction of a reference state (household characteristics, market opportunities and prices) is made in order to compare welfare across households and opportunity sets.[5] A recent example of a policy simulation exercise using a consistent social evaluation methodology that is close to the one adopted in this paper is provided by Fortin et al. (1993). Their study, however, relies on a calibrated (not estimated) and a rather restrictive model of household labour supply based on a Stone-Geary utility function that has not been subjected to empirical testing.

The methodology for welfare evaluation is explained in Sect. 2, whilst the tax reforms in question and a brief outline of the 1993 tax regime are described in Sect. 3 and Appendix B. The simulation results are also reported in Sect. 3. Sect. 4 provides concluding remarks.

2. Behavioural micro-simulation and welfare evaluation

The simulation tool is a microeconometric model of household labour supply, previously estimated on 1993 data. Some essential features of the model are synthetically illustrated in Appendix A[6]. Here we recall the general format of the estimation and policy simulation steps. The i-th household (a couple) is assumed to choose a "job" from a choice-set Ω_i. The choice set specification accounts for quantity constraints, limits to the choice of work hours and different opportunities between households and genders. Each job alternative contains wife's gross wage rate w_{iF}, husband's wage rate w_{iM}, wife's hours of work h_{iF}, husband's hours of work h_{iF} and unobserved (by the analysts) job characteristics z. As examples of z we can think of commuting time, environmental characteristics of the job, skill content of the job etc. The choice set contains also non-market activities, i.e., jobs with $w = 0$ and $h = 0$. Let $Y_i = w_{iF}h_{iF} + w_{iM}h_{iM} + m_i$ be the gross household income associated with a particular job, where m_i represent other (exogenous) income. Net household income under tax-transfer regime k will then be $C_i^k = Y_i - R^k \ (w_{iF}h_{iF}, w_{iM}h_{iM}, m_i)$, where $R^k(\cdot)$ – a function of gross incomes-$((\frac{I}{m}))$represents the tax-transfer rule that computes the net tax to be paid under tax-transfer regime k. Preferences are represented by the utility function $U_i(C_i^k, h_{iF}, h_{iM}, z)$. The i-th household then solves the problem

$$\begin{aligned} &\max_{(C_i^k,\, h_{iF},\, h_{iM},\, z)\in\Omega_i} U_i(C_i^k, h_{iF}, h_{iM}, z) \\ &s.t. \\ &C_i^k = Y_i - R^k(w_{iF}h_{iF}, w_{iM}h_{iM}, m_i) \end{aligned} \tag{2.1}$$

The observed 1993 behaviour is assumed to be generated by the solution of the problem above under the 1993 tax-transfer regime. The data set used includes 2160 married couples in age 18 – 54 belonging to the 1993 Bank-of-Italy Survey of Household Income and Wealth (SHIW93). On the basis of observed behaviour we estimate the utility function and the parameters of the choice sets[7]. The simulation consists in solving

$$\max_{(C_i^k,\, h_{iF},\, h_{iM},\, z)\in\Omega_i} U_i(C_i^k, h_{iF}, h_{iM}, z)$$

s.t.

$$C_i^k = Y_i - R_i^k(w_{iF}h_{iF}, w_{iM}h_{iM}, m_i) \tag{2.2}$$

$$\sum_i R_i^k(w_{iF}h_{iF}, w_{iM}h_{iM}, m_i) = \sum_i R_i^{1993}$$

The first constraint is the i-th household's budget constraint. The second one is the constant-tax-revenue constraint and concerns all households.

Let $V_i(\Omega_i, m_i, R^k)$ represent the maximum utility level attained by household i, endowed with exogenous income m_i, facing choice set Ω_i and tax-transfer rule R^k. Let us consider now a *reference household* S that faces choice set Ω_S, and a *reference tax-transfer rule* R^S. We ask what is the exogenous income y_i^k that would allow the reference household in the reference setting to reach utility $V_i(\Omega_i, m_i; R_i^k)$:

$$V_i(\Omega_i, m_i, R^k) = V_S(\Omega_S, y_i^k, R^S) \tag{2.3}$$

Thus, $y_i^k = y_i^k(\Omega_i, R^k, m_i; \Omega_S, R^S)$ is a generalisation of the concept of *indirect money-metric utility* as defined in Varian (1992) or in King (1983)–where it is called *equivalent income*.[8] The use of a reference choice set Ω_S and a reference tax-transfer rule R^S allows comparisons between policy reforms defined by changes in R and/or Ω. The use of a reference household (or reference household characteristics) makes it meaningful to compare and aggregate the household-specific equivalent incomes.

Let us suppose the *status quo* is some tax-transfer rule R^0. Under this regime, household i attains utility level $V_i(\Omega_i, m_i, R^0)$. The money-metric representation y_i^0 of this utility level is implicitly defined by

$$V_i(\Omega_i, m_i, R^0) = V_S(\Omega_S, y_i^0, R^S) \tag{2.4}$$

Now, a new tax-transfer rule R^1 is introduced. The corresponding *equivalent income* y_i^1 is defined by

$$V_i(\Omega_i, m_i, R_i^1) = V_S(\Omega_S, y_i^1, R^S) \tag{2.5}$$

The *equivalent incomes* y_i^1 and y_i^0 for household i represent the levels of (exogenous) income that affords the reference household S the same level of utility under the reference choice set Ω_S and the reference tax-transfer system R^S as household i attains under tax systems R^1 and R^0 (and choice set Ω_i). Thus, the difference between y_i^1 and y_i^0 for household i emerges as an appropriate measure of the household-specific welfare effect of changing tax-transfer system from R^0 to R^1. Moreover, since the money values of the household's utilities are defined in terms of a reference household who faces fixed prices and a fixed choice set, this welfare measure are comparable across

households. The difference between the two *equivalent incomes* can be interpreted as a monetary measure of welfare change and we will call it Comparable Welfare Gain:

$$CWG_i = y_I^1 - y_i^0 \tag{2.6}$$

We use flat tax (FT) as the reference tax system. The reason for this choice is that the evaluation of the equivalent income defined by Eq. (2.3) is computationally much more convenient if the reference system is a system where tax rates are not subject to choice. Any alternative reference tax system will imply endogenous tax rates. The reference tax-transfer rule will be the FT rule (defined above) that generates the same net revenue as the actual 1993 rule.

It should be emphasised that due to the random utilities employed here we have to perform stochastic simulations in order to generate the distribution of the CWGs. The decile-specific mean values of CWG are reported in Sect. 3.

As indicated above the CWG-values may depend on the choice of reference household. Thus, it is important to examine the sensitivity of the results with regard to the choice of reference household. In the simulation exercise that follows, we have alternatively used - as reference - the household (and the corresponding choice set) with the lowest, the median and the highest observed income. The results, however, are very similar; therefore, to simplify the exposition, we only report the results obtained when using the median income household as reference.

Although the distributions of CWG generated by alternative tax reforms provide important information for evaluating the welfare effects of tax reforms, a complete ranking of these distributions may require the use of a social welfare function. Moreover, social welfare functions serve as primary quantities for summarising the information content of the distribution of CWGs. In this study we use the following family of rank-dependent social welfare functions

$$W_{b,k} = \int_0^1 p_b(t) F_k^{-1}(t) dt, \quad b = 1, 2, \ldots, \tag{2.7}$$

where F_k^{-1} is the left inverse of the cumulative distribution function of *equivalent income* under tax-transfer rule k and $p_b(t)$ is a weight function defined by

$$p_b(t) = \begin{cases} -\log t, & b = 1 \\ \frac{b}{b-1}\left(1 - t^{b-1}\right) & b = 2, 3, \ldots \end{cases} \tag{2.8}$$

where b is the inequality aversion parameter[9]. Note that the inequality aversion decreases when b increases. It follows by straightforward calculations that $W_{b,k} \leq \mu_k =$ mean of the distribution $F_k(y)$, and that $W_{b,k}$ is equal to μ_k if and only if F_k is the egalitarian distribution. Thus, $W_{b,k}$ can be interpreted as the equally distributed equivalent level of *equivalent income* under tax regime k.

Aaberge (2000) demonstrated that the following family of inequality measures,

$$C_{b,k} = 1 - \frac{W_{b,k}}{\mu_k}, \quad b = 1, 2, \ldots \tag{2.9}$$

yields a complete characterisation of the distribution function F_k provided that the mean is known[10]. Moreover, Aaberge (2000) argued that the use of a few of these inequality measures may give a good summarisation of inequality in the distribution function.

When the tax-benefit rule is changed from R^0 to R^1 expression (2.9) can be exploited to measure the *proportionate social gain*[11] defined by the expression

$$\xi_b = \frac{W_{b,1}}{W_{b,0}} = \frac{\mu_1(1 - C_{b,1})}{\mu_0(1 - C_{b,0})}. \tag{2.10}$$

Expression (2.10) shows that the effect on social welfare can be decomposed into the product of the efficiency effect $\frac{\mu_1}{\mu_0}$ and the equality effect $\frac{(1-C_{b,1})}{(1-C_{b,0})}$. In the limiting case when b $\rightarrow \infty$, ζ_b reduces to the ratio between the means of the post- and pre-reform *equivalent incomes*. Therefore we also have:

$$\xi_b = \xi_\infty \frac{(1 - C_{b,1})}{(1 - C_{b,0})} \tag{2.11}$$

3. Tax reforms

Since the model we use for the tax simulations is estimated on 1993 data, we take the 1993 tax rule as the status quo (R^0). It is essentially a system of increasing marginal tax rates, going from 10% (up to 7,2 millions of ITL) to 50% (over 300 millions of ITL), which are applied to *individual* total annual income. For more details we refer to the Appendix B. Since 1993 the number of brackets has been reduced, but the essential characteristics of the system are still the same.[12]

The hypothetical reforms are stylised representations of ideas that – as mentioned in section 1 – are a matter of debate and proposal in Italy as well as in other OECD countries, with differing focus on different aspects of the tax regime. On the one hand there is a quest for a flatter profile of the marginal tax rates in order to reduce disincentives and enhance efficiency[13]. On the other hand, and specifically in Italy, it is recognised that the system of basic income support provides transfers that are not cost-effective and do not respond to any explicit design of social or family policy, and that therefore the system needs to be rationalised on a more transparent and universalistic basis. Under different labels, the ideas belonging to this second strand, converge on proposing some type of basic income scheme, either in the form of a universal transfer or in the form of transfer that compensate incomes up to a basic level. The quests for more efficiency *via* a flatter tax profile and for more, or not less, equality *via* a more cost-effective system of income support are far from being mutually exclusive. In fact many proposals (e.g. Atkinson 1995 and, for Italy Rizzi and Rossi 1997, and more recently Ministero del Tesoro 2000) match a flat tax with a basic income scheme. In what follows, we evaluate three different systems that in one way or another can satisfy these criteria. The first is a proportional or flat tax (FT). If Y represents total gross income, the tax R^{FT} to be paid by the household is

$$R^{FT} = t_{FT} Y \tag{3.1}$$

where t_{FT} is a constant marginal tax rate. Besides incorporating the idea of minimising distortions, it is also a benchmark system, useful for comparison. As mentioned above it will also be used as the reference tax rule since it is computationally convenient to do so.

The second reform is a simple negative income tax (NIT), where a flat tax is complemented with a transfer (a negative tax) that guarantees households' income up to a basic level G[14]:

$$R^{NIT} = \begin{cases} Y - G & \text{if } Y \leq G \\ t_{NIT}(Y - G) & \text{if } Y \geq G \end{cases} \tag{3.2}$$

Last, we consider the so-called WorkFare (WF) system, which essentially is a modification of NIT where the transfer is received only if the household works a minimum required amount of hours[15],

$$R^{WF} = \begin{cases} 0 & \text{if } Y \leq G \text{ and } H < H_{\min} \\ Y - G & \text{if } Y \leq G \text{ and } H > H_{\min} \\ t_{WF}(Y - G) & \text{if } Y \geq G \end{cases} \tag{3.3}$$

where t_{WF} is a constant marginal tax rate, H represent the total hours worked by the wife and the husband and H_{min} is a minimum required number of hours worked (set equal to 1000 in the simulation). Although similar to the NIT, the WF system is interesting to analyse, both because it may have better chances to receive political support and because of the theoretical argument according to which under certain conditions it can be proved to be Pareto-superior to NIT.[16]

Note that R^{FT}, R^{NIT} and R^{WF} are functions of the wife and husband's earnings and the other income of the couple. NIT and WF are interpreted as reforms that try to compound the criterion of lessening distortions from high marginal tax rates and the criterion of redesigning the basic income support system in a more effective way. Since the actual basic income support policies are thought to be rather wasteful and occasionally even inequitable, there might be scope for reforms that are able to increase both efficiency and equality.

For each of the reforms illustrated above, the simulation consists in solving problem (2.2). For each reform there is a marginal tax rate that must be endogenously determined by the simulation as the one generating the same total tax revenue as of 1993, given the other parameters of the tax-transfer rules[17]. The constant-revenue marginal tax rates turn out to be 0.184 (FT), 0.284 (NIT) and 0.273 (WF). The average net tax rate (i.e., the ratio of total net tax revenue to total gross income) is 0.20 under 1993 regime and goes down to 0.184 (FT), 0.198 (NIT) and 0.195 (WF). Since net tax revenue is kept constant, the result of a lower average tax rate reveals that all the reforms induce behavioural changes that generate a larger total gross income.[18]

As a way of summarising the basic behavioural features implied by the model, before entering the illustration of reforms simulation, in Table 1 we show the labour supply elasticity with respect to wage, broken down by gender and household income. They are obtained by increasing gross wages by 1%, computing the new labour supply choices individual by individual and then averaging across the sample. We observe a very clear-cut difference of responsiveness between wife and husband and a marked inverse dependence of elasticity on household income[19]. This pattern of elasticities suggests that

Table 1. Labour supply elasticity for married females and married males by deciles of household disposable income

Type of elasticity		Female elasticity		Male elasticity	
		Own wage elasticities	Cross elasticities	Own wage elasticities	Cross elasticities
Elasticity of the probability of participation	1	2.40	0.26	0.04	−0.02
	2	1.35	−0.19	0.05	−0.02
	3–8	0.54	−0.18	0.01	−0.01
	9	0.16	−0.16	0.02	−0.01
	10	0.10	−0.15	0.02	0.00
Elasticity of the conditional expectation of total supply of hours	1	1.60	0.55	0.28	0.08
	2	0.83	0.05	0.12	0.02
	3–8	0.18	−0.06	0.08	−0.02
	9	0.04	−0.04	0.06	−0.02
	10	0.04	−0.02	0.04	−0.02
Elasticity of the unconditional expectation of total supply of hours	1	4.44	0.82	0.32	0.06
	2	2.31	−0.15	0.17	0.00
	3–8	0.73	−0.24	0.10	−0.04
	9	0.20	−0.20	0.08	−0.03
	10	0.13	−0.17	0.06	−0.02

women living in low or average income households play a crucial role in determining reform effects, provided the reform implies significant changes in incentives for them. Table 1 also reveals that cross-elasticities – again mostly for women in low and average income brackets – are far from irrelevant, thus giving support to the choice of modelling the joint decisions by household members. Below we suggest that they significantly contribute in explaining some apparently counterintuitive results.

Tables 2–5 illustrate the simulation results under various perspectives. Table 2 shows the simulated effects of the alternative tax rules upon labour supply, gross income and disposable income. All the reforms lead to an increase of average household gross and net income. As expected the FT scheme creates less distortion on labour supply than the NIT and WF schemes. However, compared to observed labour supply under the 1993 tax rules female labour supply has a small reduction as a consequence of NIT, a small increase as a consequence of WF, and a slightly larger increase as a consequence of FT. However, whatever the reform, labour supply among females in the first two poorest deciles always increases. In other words, no significant disincentives to participation or any ''poverty trap'' effects emerge in the lowest two deciles[20]. Among the possible explanation of this apparently counterintuitive result, we stress two. First, the pattern of cross-elasticities reported in Table 1 shows that the cross elasticity of labour supply for the wives in the two poorest deciles (with respect to the husband's wage) is positive (0.82%). Also, for a majority of men, the marginal wage rate increases as a consequence of any of the reforms, particularly on full-time jobs. Given the positive cross-elasticity, this leads to an increase in the wife's labour supply. Second, there is a possible effect of the interactions of the reforms with the quantity constraints on the hours choice. As explained in Appendix A, the model accounts for the fact that not every type of job is equally available to every individual. If, for example, part-time jobs are hard

to find, at least for some women, the relevant comparison is the one between non-participation and full-time jobs. In a sense, the average net wage rate becomes more relevant than the marginal net wage. Thus, it may well be the case that a reform implies a higher (compared to the 1993 system) net income on a full-time job. This effect will encourage participation even if the entrance marginal tax rate is higher (FT) or if unearned income increases (NIT and WF). Note that a traditional model, where different job type availability is not taken into account, could not have captured such an effect. Overall, it is worthwhile noting that the specific features of the microeconometric model employed – partners' simultaneous choices, constraints in the choice of hours and ability to capture a large variety of supply responses – turn out to be crucial in explaining the simulation results.

In Table 3 we present the mean value CWGs of the three reforms outlined above, disaggregated by 1993 household welfare decile and by "winners" and "losers". For each reform, three simulation exercises have been performed, using three different reference households. However, since the results are

Table 2. Participation rates, annual hours of work, gross income, disposable income and taxes for married couples under alternative tax regimes by deciles of disposable household income under 1993-taxes

Tax regime	Decile	Participation rates, %		Annual hours of work				Households, 1000 ITL 1993		
		M	F	Given participation		In the total population		Gross income	Taxes	Disposable income
				M	F	M	F			
1993-tax rules	1	95.6	14.1	1571	1030	1501	145	15221	525	14695
	2	97.5	19.9	1832	1209	1787	241	24372	2109	22263
	3–8	98.9	43.8	1991	1546	1970	677	48187	8960	39227
	9	99.3	65.5	2117	1731	2103	1133	85135	19983	65152
	10	99.4	74.4	2237	1828	2225	1361	128396	34365	94032
	All	98.5	43.7	1972	1590	1943	694	54225	11074	43150
FT	1	95.4	19.6	1706	1264	1627	247	22933	4219	18714
	2	97.8	24.4	1924	1397	1882	342	31761	5845	25917
	3–8	99.0	44.7	2048	1585	2027	709	54142	9961	44181
	9	99.4	64.5	2162	1741	2150	1124	89459	16460	72999
	10	99.5	73.2	2267	1834	2257	1344	132888	24452	108435
	All	98.6	45.0	2036	1623	2008	731	60189	11074	49115
NIT	1	95.28	14.44	1551	1056	1478	152	16404	−1952	18356
	2	97.13	19.91	1820	1240	1768	247	26199	2537	23662
	3–8	98.63	41.42	1996	1540	1969	638	49801	9538	40263
	9	99.21	63.29	2138	1733	2121	1097	86985	20218	66767
	10	99.49	72.59	2252	1832	2241	1331	130581	32714	97867
	All	98.29	41.87	1976	1589	1942	665	55897	11074	44823
WF	1	95.32	15.19	1621	1117	1545	170	17655	−247	17902
	2	97.45	20.28	1866	1285	1818	260	27280	2956	24324
	3–8	98.82	42.20	2018	1548	1994	653	50669	9487	41182
	9	99.31	63.56	2145	1738	2130	1105	87455	19569	67885
	10	99.49	72.96	2256	1833	2244	1338	131013	31538	99476
	All	98.45	42.52	2001	1597	1970	679	56742	11074	45668

Notes: The results for WF are new, while the results for 1993, FT and NIT are taken from Aaberge et al. (2000).

Table 3. The distribution of CWG by losers and winners, and by deciles of household *equivalent income*[1] under 1993-taxes when the 1993 tax regime is replaced by various alternative tax regimes

Tax-transfer rule	Deciles	Winners % of the total population	Average CWG in 1000 ITL		
			All couples	Losers	Winners
FT	1	41.5	−122	−5228	7051
	2	43.5	457	−5641	8310
	3–8	52.0	2848	−6029	11058
	9	60.1	6307	−6607	14926
	10	60.9	7325	−8299	17460
	All	51.8	3105	−6121	11703
NIT	1	65.3	3039	−2620	6082
	2	59.2	2208	−2762	5634
	3–8	54.6	1736	−3998	6526
	9	51.4	1573	−5595	8408
	10	46.1	−808	−9719	9726
	All	55.0	1643	−4640	6821
WF	1	64.8	2750	−2656	5732
	2	59.3	2165	−2773	5540
	3–8	55.4	1835	−3958	6531
	9	52.6	1793	−5551	8459
	10	47.6	−478	−9668	9776
	All	55.6	1724	−4594	6790

[1] Equivalent income and CWG are defined using the median income household as reference

similar, for simplicity of exposition we only report the results obtained with the median income household as reference[21]. All the reforms are more efficient than the 1993 rule, since for each reform the overall average CWG is positive. Also the overall proportion of winners is always positive. However, the distributional effects are very different. It seems clear that FT is disequalising, since the average CWG is negative for the worst-off fraction of the sample. Also, there is a majority of losers in the worst-off deciles. On the other hand the results of Table 3 suggest that NIT and WF might be equalising, since the only decile to loose is the best-off one. Note that the identification of the proportions of winners and losers solely requires *ordinal utility* information. Thus, the estimates of the proportions of winners and losers are independent of the choice of reference state.

In Tables 4 and 5 we extend the analysis to the social welfare effect and its components. We use $W_{b,k}$ defined by (2.7) and (2.8) for $b = 1, 2, 3$ and ∞ The corresponding measures of social welfare have been calculated for both the pre- and post-reform distributions of equivalent income. The values of proportionate social gain ξ_b defined by (2.10) are given in Table 4. All the reforms produce a positive social gain for any value of the inequality aversion parameter b. As we have noted above, ξ_∞ ignores distributional effects and solely captures the efficiency gains of the reform. In other words, the last column of Table 4 contains the ratio between the average *equivalent income* under a certain reform and the average *equivalent income* under the 1993 rule. Thus, if we only care about efficiency we look at the last column and read that social gain is 2.1% under FT, 0.8% under NIT and 1.1% under WF. If we also care about the distribution of equivalent income, and we adopt – say – a Gini welfare function (i.e. we use (2.7) with b = 2), then the social gain is

Table 4. Proportionate social gain under the tax-transfer reforms

Tax-transfer rule	ξ_b			
	b = 1	**b = 2**	**b = 3**	**b = ∞**
FT	1.002	1.009	1.012	1.021
NIT	1.020	1.015	1.013	1.008
WF	1.019	1.016	1.015	1.011

Table 5. Equality effects of the tax-transfer reforms

Tax-transfer rule	$(1 - C_{b,1})/(1 - C_{b,0})$		
	b = 1	**b = 2**	**b = 3**
FT	0.981	0.988	0.991
NIT	1.012	1.007	1.005
WF	1.008	1.005	1.004

0.9% under FT, 1.5% under NIT and 1.6% under WF. As we can see from (2.10) or (2.11), the proportionate social gain of Table 4 can be factored into the efficiency effect (i.e. ξ_∞) and the equality effect (i.e., $(1 - C_{b,1})/(1 - C_{b,0})$). Table 5 reports the equality effects. The reforms are equalising (disequalising) if the entries are greater (lower) than 1. For example, equality is increased by 0.7% under the NIT reform when we employ the Gini welfare function (i.e., b = 2).

Table 4 and Table 5 together reveal that all the reforms attain a positive social gain but through a different route. Namely, FT is efficient but disequalising; the social gain is positive since the efficiency effect more than compensates the disequalising effect, even when social welfare function (the Bonferroni welfare function, b = 1) exhibits rather strong inequality aversion. On the other hand, NIT and WF are both efficient and equalising with respect to the 1993 rule. It appears therefore that it is possible to overcome the trade-off between efficiency and equality. NIT and WF just provide two examples. It is worthwhile noting however that the benefits from the reforms seem to come from an unexpected direction. Most advocates of lower marginal tax rates for higher incomes (as it is true of all the three reforms we have simulated) tend to think that the rich are more responsive than the poor. According to this view, thanks to better incentives, the rich would increase labour supply and take up more productive opportunities, and by this way they would contribute to a bigger cake. Looking into the details of our simulation, however, we discover that what happens is quite the opposite. Table 2 reveals that the largest response to the reforms in terms of hours comes from households belonging to low and average income deciles. This is also consistent with the pattern of supply elasticities presented in Table 1. The reforms we have simulated indeed exploit already *some* of the implications of this pattern of behavioural responses, by lowering marginal taxes also for some fraction of the average income population. For example, an individual income of 30,000,000 ITL (somewhat above the average individual income in 1993) would face – according to 1993 tax rule – a marginal tax rate equal to 34%. For the same income, the marginal tax rates under the reforms would be lower (FT: 18.4%; NIT: 28.4%; WF: 27.3%). Moreover, under NIT and

WF rules, the reformed marginal tax rates – although rather low in absolute terms – are high enough to finance a guaranteed income such that both rules turn out to be also equalising (besides being more efficient with respect to the 1993 regime). However, for the very high incomes – say those facing a 51% marginal tax rate – the gain is obviously much higher, although their supply elasticity is close to zero. NIT or WF might probably be improved upon for example by using a two-rate tax instead of the flat rate, with the lower rate imposed on low and average incomes. Interestingly enough, a tax-transfer rule of this sort appears to enlarge the scope for an improvement of both efficiency and equality, since then lower tax rates would fall upon the individuals who are both more elastic and poorer.[22]

4. Summary and discussion

Using a flexible microeconometric model of household labour supply, we have simulated behavioural responses and welfare gains and losses for married couples resulting from replacing the Italian tax system as of 1993 by three alternative tax-transfer regimes: a flat tax, a negative income tax and a work-fare system. The flexibility of the model rests upon

- a fully simultaneous representation of partners' decisions,
- a utility function specification that, although well founded on a substantive theory of choice, does not force *a priori* any specific pattern of supply response with respect to wages or incomes,
- and on a representation of the opportunity set that allows for unobserved job characteristics and different availability of different types of job.

For the purpose of social welfare evaluation, we draw upon King (1983) by deriving welfare change measures from *equivalent incomes* (or indirect money metric utilities) defined in terms of a reference household and of the prices that this household faces. The money metric utilities are then aggregated into a social welfare criterion, which allows evaluating the reforms in terms of efficiency and equality.

As a first notable result, it turns out that all of the reforms are efficient, and that while FT is disequalising, NIT and WF are also equalising. The results are robust with respect to the choice of the reference household in computing welfare effects. Therefore the analysis suggests that there is indeed scope for designing a system that is superior to the current one according to both efficiency and equality.

A second striking result is that the main effects produced by the reforms seem to come from a direction that is very different from the expectations of most advocates of the reforms themselves. There are two widespread *clichés* circulating in the discussions about social policy and tax reforms. The first is the expectation that basic income support policies (NIT, WorkFare etc.) entail a significant reduction of labour supply in lower income deciles, with the risk of activating "poverty traps". Our results do not support this view, and we have discussed likely explanations rooted in realistic – although not standard - features of the model. Second, most advocates of tax reforms that reduce the progressivity and the marginal rates applied to higher incomes, tend to expect that this will give stronger labour supply incentives to households located in the upper deciles of income distribution. Even this

expectation receives little support from our results. All the reforms entail a significant increase of household gross income and a somewhat lower average tax rate. However, large part of the labour supply contribution comes from lower and average income households. At the root of these results there are

– the magnitude and the sign of the partners' labour supply cross-elasticities,
– the structure of the opportunity set in terms of availability of different types of jobs,
– and a marked inverse dependence of labour supply wage elasticities on household income.

The last feature above also suggest that NIT or WF might probably be improved upon moving along unconventional directions, such as lowering taxes and flattening marginal rates not so much on highest incomes but rather on low and average incomes.

Appendix

A. The microeconometric model

The model is fully described in Aaberge et al. (2000). A more technical presentation, with some differences in the empirical specification, is provided by Aaberge, et al. (1999). General foundations are given in Dagsvik (1994), and a first application is presented in Aaberge et al. (1995). Here we give a concise sketch, using the terminology introduced in Sect. 2. Two major problems have to be faced in developing empirical model of labour supply for tax reform evaluation:

- complicated tax rules may introduce non-convexities and kink-points into the budget set that make cumbersome the use of Kuhn-Tucker conditions associated to constrained utility maximisation;
- the standard textbook model is not able to reproduce well the actual distribution of hours of work, which is not unimodal but tends instead to cluster around two or three value ranges (such as, e.g. partime, fulltime and double shift).

As to the first problem, we follow the strategy of modelling the choice in terms of a direct comparison of utility levels, thus avoiding the complications implied by working with conditions involving marginal variations. Under this respect our model is close to – among others – Dickens and Lundberg (1993), van Soest (1995) and Duncan and McRae (1999). The model we adopt follows Dagsvik (1994) and belongs to the Multinomial Logit family, more precisely to its generalisation to continuous choice sets (as for example in Ben-Akiva and Watanatada 1981).

As to the second problem, the recent literature has witnessed many different approaches. One consists in introducing into the utility function a sufficiently large number of parameters – e.g. through a polynomial approximation – such that the distribution of hours can be rationalised. The risk of this approach is that it tends to explain everything with the observed variables (overfitting): it is dubious whether it produces more reliable results - with respect to simpler utility function specifications – when evaluating policy

changes or when simulating outside the estimation sample. A different, alternative or complementary, procedure consists in assuming that there are fixed costs of working. This refinement can contribute to explain why very few observations are usually found between, say, non-participation and 18–20 hours a week. Our approach is still different. First, we adopt a utility function that although flexible is amenable to a direct interpretation of the parameters in terms of economic theory. Second, we directly model the distribution of opportunities contained in the choice set, allowing for different availability of job types for different households.

The choice set Ω_i for household i contains a certain number (unknown to the analyst) of "household opportunities", each of them being described by work hours of work (h_F, h_M), gross wage rates (w_F, w_M) and by other unobserved characteristics j. The subscripts F and M refer to the wife (Female) and to the husband (Male). The choice set is modelled through the definition of the p.d.f. $p_i(h_F, h_M, w_F, w_M)$, which can be interpreted as the relative frequency (in the choice set) of an opportunities requiring (h_F, h_M) hours, paying wage rates (w_F, w_M). The choice set includes both market opportunities (jobs) and non-market opportunities (which have all zero hours and zero wage, but typically differ as to other unobserved characteristics). If (and only if) a certain opportunity contains $h_j = 0$ then it also contains $w_j = 0$.

We define:

$$p_i(h_F,h_M,w_F,w_M) = \begin{cases} p^h_{iF}(h_F)p^h_{iM}(h_M)p^w_{iF}(w_F)p^w_{iM}(w_M)p^0_{iF}p^0_{iM} & \text{for } h_F>0 \text{ and } h_M>0 \\ p^h_{iM}(h_M)p^w_{iM}(w_M)(1-p^0_{iF})p^0_{iM} & \text{for } h_F=0 \text{ and } h_M>0 \\ p^h_{iF}(h_F)p^w_{iF}(w_F)p^0_{iF}(1-p^0_{iM}) & \text{for } h_F>0 \text{ and } h_M=0 \\ (1-p^0_{iF})(1-p^0_{iM}) & \text{for } h_F=0 \text{ and } h_M=0 \end{cases} \quad \text{(A.1)}$$

where

$p^h_{ij}(h_j)$ = conditional p.d.f. of opportunities requiring h_j hours for gender j, given $h_j > 0$; it is specified as uniform with a peak corresponding to full-time;

$p^w_{ij}(w_j)$ = conditional p.d.f. of opportunities paying wage w_j for gender j, given $h_j > 0$; it is specified as log-normal, with the mean depending on Education, Age and Regional dummies; p^0_{ij} = proportion (on the opportunity set) of opportunities with $h_j > 0$ (i.e. of jobs) for gender j; it is specified as logistic with location parameter depending on regional dummies and on local gender-specific unemployment rates.

For more details on the empirical specification of the opportunity p.d.f.s we refer again to Aaberge et al. (1999) and Aaberge et al. (2000).

The utility level attained by household i when choosing a given opportunity depends however not only on the observed characteristics of the opportunity (hours and wages) and of the household, but also on unobserved characteristics. We assume that utility can be factorised as $U_i(C_i, h_{iF}, h_{iM}, z) = \Psi_i(C_i, h_{iF}, h_{iM}) + \varepsilon_i(z)$, where ε is a random variable accounting for the joint effect of household's and opportunity's unobserved characteristics. We assume the ε s are independent draws from a standard Type I extreme value distribution, i.e., $\text{Prob}(\varepsilon \leq E) = \exp\{-\exp\{-E\}\}$.

For the systematic utility a Box-Cox functional form is chosen:

$$\begin{aligned}\Psi_i(C,h_F,h_M) = {} & [\alpha_2 + a_3 N]\cdot\left(\frac{C^{\alpha_1}-1}{\alpha_1}\right) \\ & + \left[a_5 + a_6 \ln A_M + a_7 (\ln A_M)^2\right]\cdot\left(\frac{L_M^{a_4}-1}{a_4}\right) \\ & + \left[a_9 + a_{10}\ln A_F + a_{11}(\ln A_F)^2 + a_{12} CU6 + a_{13} CO6\right] \\ & \times \left(\frac{L_F^{a_8}-1}{a_8}\right) \end{aligned} \tag{A.2}$$

where C is annual household net (disposable) income, N is the size of the household, A_j is the age of gender j, *CU6* and *CO6* are the number of children below and above 6 years old and L_j is the proportion of leisure for gender j, defined as $L_j = 1 - \frac{h_j}{8760}$, and h_j is annual hours of work.

The functional form chosen for representing utility is flexible in the sense that it permits many different shapes of labour supply curves and does not impose a priori any specific dependence of supply from income or wage. One could assure even more flexibility by - for example - introducing interaction terms or by using polynomial approximations. Flexibility, however, has to be balanced against other relevant criteria. We favoured a functional form that – although flexible – still permits a direct economic interpretation of the parameters. There is also a more fundamental motivation for relying on such a form, which is rooted in psychophysical measurement theory. Dagsvik and Strøm (2003) prove that a form such as (A.2) is consistent with certain invariance assumptions on preferences. A related, although not equivalent, result was also proved by Luce (1959).

Given the assumptions above, the probability of observing household i choosing an opportunity containing h_F, h_M, w_F and w_M turns out to be[23]:

$$\varphi_i(h_F,h_M,w_F,w_M) = \frac{\exp\{\Psi_i(C_i,h_F,h_M)\}p_i(h_F,h_M,w_F,w_M)}{\int\int\int\int \exp\{\Psi_i(Z_i,y_F,y_M)\}p_i(y_F,y_M,x_F,x_M)dy_F dy_M dx_F dx_M} \tag{A.3}$$

with

$$C_i = w_{iF}h_{iF} + w_{iM}h_{iM} + m_i - R(w_{iF}h_{iF}, w_{iM}h_{iM}, m_i)$$

and

$$Z_i = x_F y_F + x_M y_M + m_i - R(x_F y_F, x_M y_M, m)$$

where $R(\ )$ is the tax paid and m_i is exogenous income. The choice probabilities can then be used to jointly estimate the parameters of the utility function and of the opportunity density functions by Maximum Likelihood. The estimates are reported in Aaberge et al. (2000)[24]. The model performs very well in terms of fit to worked hours and income distribution, which suggest that the specification of the utility function and of the opportunity density function are sufficiently flexible to capture the large behavioural variability present in the sample.

B. The Italian tax system as of 1993

Here we summarise the main features of the personal income tax system in 1993. The essential characteristics of the systems remain unchanged in the following years, although there is a movement towards reducing the number of marginal tax rates, introducing a slightly less progressive profile, and increasing the amount of the family benefits.

The unit of taxation is the individual. To the individual total taxable income, the following marginal tax rates are applied:

Income (1000 LIT)	Marginal tax rate (%)
Up to 7,200	10
7,200 – 14,400	22
14,400 – 30,000	27
30,000 – 60,000	34
60,000 – 150,000	41
150,000 – 300,000	46
Over 300,000	51

In our sample (Bank of Italy Survey of Household Income and Wealth, 1993) the average household gross income and the average taxes paid in our sample are respectively 54,525,000 ITL and 11,074,000 ITL. Some expenditures (such as medical or insurance) can be deducted from income before applying taxes. Child allowances (83,100 ITL for each child) and dependent spouse allowances (719,300 ITL) – up to the amount of the gross tax – can be subtracted from the tax. Allowances are also granted to wage workers (690,600 ITL for everyone plus 215,800 ITL if the gross income is below 13,200,000 ITL). For example, one implication of the tax allowances is that for tax payer with dependent spouse the marginal tax rate attached to the first bracket is zero. Conditional on the number of household members, on household total income, and on being a wage worker, the head of the household receives family benefits. These transfers are comparatively rather low, besides being conditional on occupational status. For example, a household with 1 child would receive 720,000 ITL if total household gross income is below 17,306,000 ITL, 240,000 ITL if income is above 17,306,000 and below 21,632,000, nothing if income is above 21,632,000. The transfers have been increased since 1993b even in real terms but they remain low in comparison to other European countries.

Endnotes

[1] Ministero delle Finanze (1994)

[2] See Commissione Onofri (1997) for analyses and proposals elaborated upon these issues during the last centre-left government.

[3] Ministero del Tesoro (2000).

[4] Baldini and Bosi (2001) use a static micro-simulation model to evaluate the effects on income distribution and on net tax revenue of the two reforms contained in the electoral platforms of the two opposed coalitions, and conclude that they both are undesirable. The (almost) flat tax proposal – proposed by the centre-right coalition – would according to the results of Baldini and Bosi – entail a major loss in revenue; to keep revenue constant an unbearably high rate

would be required. On the other hand, the "social dividend + flat rate" reform – proposed by the centre–left coalition – would have positive effects on redistribution but again would require an exceedingly high flat rate to keep the revenue constant. Another example of non–behavioural simulation analysis of this type of reforms is provided by Bourguignon et al. (1997).

[5] We also checked the sensitivity of the results with respect to the choice of the reference state.

[6] A full presentation of the model and more details on data and estimation can be found in Aaberge et al. (1999) and Aaberge, Colombino, Strøm and Wennemo (2000). Some key features are illustrated in Appendix A. The model allows for observed as well as unobserved characteristics in preferences and opportunities, for spouses' simultaneous decisions, for non–convex budget sets due to the complexity of the tax system and for quantity constraints on the choice of hours of work. Previous structural labour supply models estimated on Italian data include Colombino (1985) and Colombino and Del Boca (1990).

[7] The estimates of this specific version of the model are present in Aaberge et al. (2000).

[8] The concept must not be confused with the homonymous one used in the equivalence scales literature.

[9] Several authors have discussed rationales for this approach, see e.g., Donaldson and Weymark (1980, 1983), Weymark (1981), Yaari (1988), Ben Porath and Gilboa (1992) and Aaberge (2001).

[10] Note that $\{C_{b,k}, b \geq 2\}$ is the "generalised" Gini family introduced by Mehran (1976). It can be easily verified that C_{2k} is equal to the Gini coefficient. For unimodal distributions that are not strongly skew to the right or left the Gini coefficient is most sensitive to changes that take place in the middle part of the income distribution. As noted by Aaberge (2000) C_{1k} exhibits strong downside inequality aversion and is equivalent to a measure of inequality that was introduced by Bonferroni (1930). By contrast, C_{3k} exhibits upside inequality aversion and therefore yields a supplement to the information provided by the Gini coefficient and the Bonferroni coefficient.

[11] The terminology is taken from King (1983).

[12] In the text and in the tables, the figures are in 000's of Italian *Lire*. In order to translate into EURO, the figures should be divided by 1.93627.

[13] Another motivation for less progressive tax rates is to reduce the incentives to evasion and elusion.

[14] In this exercise we limit ourselves to the NIT and do not consider the possibly less realistic basic income in the form of a universal unconditional transfer. The idea of a minimum guaranteed income or alternatively of a universal basic income or wealth transfer, has a long tradition in economics and political philosophy and can be traced back to Tom Paine, Charles Fourier and John Stuart Mill amongst others. More recently, it motivated proposals from scholars with radically different ideology, from Friedman (1964) to Van Parijs (1995), passing through Tobin (1966), Meade (1978) and Atkinson (1995) to cite a few. A recent articulated proposal for a universal transfer in the form of an initial endowment is put forward by Ackerman and Alstott (1999). Targetti Lenti (2000) provides a survey with focus on the Italian case.

[15] In the simulation exercise we put $H_{min} = 1000$ (cumulatively for the two partners). Alternatively – and more generally – one might think of making the transfer conditional on some other decision made by the household, such as taking part in a training program.

[16] See Fortin et al. (1993).

[17] For FT, the marginal tax rate is of course constant for any level of income. For NIT and WF is the (constant) marginal tax rate applied to incomes above the guaranteed level G.

[18] This effect can be due to more participants, and/or more hours worked among participants, and/or a more productive pool of participants (i.e. a favourable selection effect).

[19] It is worthwhile noting that the functional form adopted for representing household utility (see Appendix A) does not imply a priori any particular relationship between supply elasticity and household income or individual wage.

[20] One would expect a disincentive to participation from FT – since it increases the entrance marginal tax rate) –, and a poverty trap effect (on top of a disincentive to participation) from NIT (if not from WF) – since it guarantees an income G even to non-participants and applies a 100% tax rate up to the point when labour income reaches G. As explained in the main text, however, these arguments might cease to be valid once it is recognised that not every type of job – and in particular not every hours value – is equally available.

[21] The results obtained with the three different reference households are reported in a working paper by Aaberge, Colombino and Strøm (2001) that can be downloaded from CHILD web page (www.child-centre.it).

[22] Note that the argument is at odds with a widespread opinion, according to which efficiency should be pursued by cutting taxes on the highest incomes. See Røed and Strøm (2001) and Fitoussi (2000) for – respectively – a recent provocative survey and an informed opinion that also oppose the conventional wisdom. We are using here an argument inspired by the Ramsey – inverse elasticity – rule, according to which less elastic behaviours should be taxed more in order to collect a given amount. Of course the argument cannot be used literally in this context since the criterion that differentiates elasticities (i.e. household income) depends also on the elasticities themselves. Computations by Saez (2001) seem to give support to the above conjecture. However Saez uses a calibrated model based on a rather restrictive specification of preferences. A rigorous analysis fully exploiting the complexity of our empirical model would require locating the tax rule that maximises social welfare over a general family of tax rules. This is however computationally very cumbersome, unless the rule can be defined by two or three parameters as in the exercises illustrate in this paper. We are currently working on extending the simulation procedure to more general families of tax rules.

[23] For the derivation of the choice density see Aaberge et al. (1999). The choice densities are similar to those produced by the continuous multinomial logit of Ben-Akiva and Watanatada (1981). The basic versions of the models developed for example by vanSoest (1995) and Duncan and McRac (1999) can be interpreted as special cases of (A.3) where the p.d.f.s p_i are set equal to a constant.

[24] The estimates can be obtained by the authors upon request.

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